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THE ASPIN PLAN: A RESOURCE ALLOCATION STRATEGY FOR TODAY

BY

COLONEL ROY W. L'HEUREUX
United States Army

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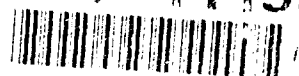
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Changes in the global security environment of the 1990's dictate substantial reductions in U.S. defense spending. If the U.S. defense technology and industrial base (DTIB) is to adequately support future military requirements, an effective resource allocation strategy must be proposed, accepted and implemented in a timely manner. In February 1992 Les Aspin, former Chairman of the House Armed Services Committee, outlined a resource allocation strategy designed to sustain the critical elements of the DTIB, maintain U.S. technological superiority, and keep ahead of the proliferation of militarily significant weapons throughout the world. The Aspin Plan consists of four resource allocation strategies: 1) selective upgrading of existing weapon systems to improve performance or reduce life cycle cost; 2) selective low-rate procurement of unique military equipment; 3) continuous prototyping of technology using a rollover-plus strategy; and 4) procurement of a limited quantity of "silver bullet" systems.

The Aspin Plan provides the framework for alleviating America's national concerns for balancing present and future military needs under a declining defense budget. If properly implemented, the Aspin Plan will support current production requirements, sustain the critical elements of the DTIB for future production, and develop the advanced technology necessary to retain America's technological superiority on the battlefields of the future.

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THE ASPIN PLAN: A RESOURCE ALLOCATION STRATEGY FOR TODAY

AN INDIVIDUAL STUDY PROJECT

by

Colonel Roy W. L'Heureux
United States Army

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A Thought

The American Army had developed improved 3.5-inch rocket launchers, which would penetrate the T-34. But having designed them, it hadn't thought to place them in the hands of the troops, or of its allies. There just hadn't been enough money for long-range bombers, nuclear bombs, aircraft carriers, and bazookas too. Now, painfully, at the cost of blood, the United States found that while long-range bombers and aircraft carriers are absolutely vital to its security, it had not understood in 1945 the shape of future warfare.

To remain a great power, the United States had to provide the best in nuclear delivery systems. But to properly exercise that power with any effect in the world - short of blowing it up - the United States had also to provide the bread-and-butter weapons that would permit her ground troops to live in battle.

If it did not want to do so, it had no moral right to send its troops into battle.¹

T. R. Fehrenbach

The Challenge

Unfortunately, if you look at the historic record, we have never, ever gone through one of these periods and gotten it right. We've always screwed it up. Every single time when it's happened previously we've been so quick to cash in the peace dividend, to demobilize that force, that within a very short period of time we find that our weakness in and of itself becomes provocative and tempts others to do things they shouldn't attempt; that we always end up having, once again, to commit the force some place - we get in trouble some place in the world and have to send in the troops; that we find ourselves with troops that are not well trained or well equipped, not prepared to go to war.²

Former Secretary of Defense Richard Cheney

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INTRODUCTION

On February 12, 1992 Representative Les Aspin, Chairman of the House Armed Services Committee submitted a proposed methodology for balancing equipment modernization and industrial base concerns with requirements for a smaller defense budget. His proposal, entitled, "Tomorrow's Defense from Today's Industrial Base: Finding the Right Resource Strategy for a New World Era," was a new approach to defense resource allocation and provided stark contrast to emerging Pentagon acquisition strategies.

The purpose of this study is to examine the elements of the Aspin resource allocation strategy, assessing the impact of that strategy on maintenance of the defense industrial base. In the context of this study the defense industrial base is defined as, "the aggregate ability to provide the manufacturing, production, technology, research, development, and resources necessary to produce the material for the common defense of the United States."³ The methodology utilized in this study will be to select a military system that represents each element of the Aspin Plan, and assess the impact on the industrial base of that element against a set of criteria necessary to meet present and future industrial base requirements. Additionally, the study will assess the effect of the Aspin Plan on development of advanced technology for future weapon systems.

BACKGROUND

The political debate to attain a consensus on America's role in the new world order is well underway. Significant progress has been made since March 1990 when Senator Sam Nunn, Chairman of the Senate Armed Services Committee noted, "We have a Fiscal Year 1991 defense budget that is based on a 1988 threat and a 1988 strategy."⁴

With the end of the Cold War and completion of the Reagan era military modernization programs, American political leadership appears compelled to shift national priorities from international to domestic affairs. The Congressional attitude just after the fall of the Berlin Wall was perceived as time to concentrate, "on America's own problems, even at the expense of international obligations and commitments."⁵ The recent presidential election has confirmed this shift of priority towards domestic programs, signaling substantial reduction to future defense budgets. The question is no longer whether the size of the defense budget will be cut, but rather the downward limit of reduction.

In response to Congressional pressure, revisions to America's national security strategy were inevitable. By February 1991 former Secretary of Defense Dick Cheney announced revisions to the defense strategy reflecting the new world order by stating that, "(America's) goal remains to deter aggression against our nation, its allies, and its interests. Should

deterrence fail, our strategy seeks to defeat aggression on terms favorable to U.S. interests. What has changed in U.S. defense strategy is how we plan to deter and defeat aggression in the new global environment."⁶ The how of the new strategy, as outlined in the **National Security Strategy of the United States** (August 1991) and updated in January 1993, includes the concepts of strategic deterrence, forward presence, crisis response, force reconstitution and collective security.⁷ However, it is necessary to allow President Clinton sufficient time to review and validate this strategy as part of the new administration's national security strategy.

Significant reductions in the size of America's military highlighted the importance of reconstitution in supporting the military mission of the world's last remaining super power. Force reconstitution is described as a capability, "intended to deter a (threat) power from militarizing and, if deterrence fails, to provide a global warfighting capability. Reconstitution involves forming, training, and fielding new fighting units. This includes initially drawing on cadre-type units and laid-up military assets; mobilizing previously trained or new manpower; and activating the industrial base on a large scale."⁸ Therefore a significant linkage exists between reconstitution and the defense industrial base.

By mid-1991 it was evident that the impending defense drawdown and shrinking defense budget would require major changes in the defense industrial base, raising questions as to the

ability to support reconstitution. John Correl summed up these concerns as follows:

The decline of the industrial base, a chronic problem through the 1980's, has worsened precipitously. By 1997 the Joint Chiefs estimate it might take four years to restore production capabilities to the 1990 level, which itself was somewhat of a discouraging benchmark.⁹

In January 1992, former Deputy Secretary of Defense Don Atwood outlined a new defense acquisition strategy to align military requirements with budget constraints. The strategy called for emphasis on research and development over procurement, with considerable emphasis on demonstrators and prototypes. Demonstrators would be used to evaluate the effectiveness of advanced technologies in a research and development environment. Prototypes would evaluate the entire weapon system in an operational environment, including the technical performance, producibility, and life cycle supportability characteristics. While some new technology would go into production immediately, most of the resulting weapon system designs would be shelved until required for reconstitution.¹⁰

This acquisition strategy was immediately criticized by industry, congress, and the military.¹¹ Critics contend that this strategy will not support the critical elements of the industrial base, nor would it transition advanced technology to the field. This criticism is exemplified by retired General Robert Marsh, former head of Air Force Systems Command, who states: "If there is an expectation that the prototyping scheme

could sustain the industrial base, that expectation is totally false."¹² As a result of this criticism, the strategy of developing prototypes and then shelving the resulting technology was itself shelved.¹³

On 20 May 1992, former Under Secretary of Defense Don Yockey provided additional information concerning the new acquisition strategy and policies.¹⁴ Major elements of the expanded acquisition strategy include:

- 1) Continued investment of a significant amount of funds in procurement of cost effective, producible, and necessary systems (or system upgrades) to maintain the superiority of U.S. weapon systems.
- 2) Continued development of new and innovative manufacturing technologies to improve the efficiency of production.
- 3) Establishment of an industrial base oversight process which will:
 - Identify critical processes, products, or capabilities.
 - Monitor changes occurring in the industrial base to obtain early warning of the potential loss of these critical items.
 - Take actions to preserve the needed critical process, product, or capability in those exceptional situations where it may be lost and cannot be recovered in time to meet an emerging threat.
- 4) Stimulate changes in the industrial base that will increase efficiency and competition.¹⁵

Key features of this strategy include continued use of current competitive acquisition practices, identifying and addressing critical technology elements of the industrial base on an exception basis, and utilizing technology thrust areas as a means of channeling research and development into practical high-

technology applications.¹⁶ Additionally, the downward restructuring of the defense industrial base will most probably utilize a "laissez-faire approach," resulting in a Darwinian "survival of the fittest" struggle to determine which companies will comprise the defense industrial base of the future.

In a 1992 position paper by the American Defense Preparedness Association, certain key Pentagon assumptions concerning the defense industrial base were summarized as follows:

(Pentagon) posture statements discuss the availability of a sufficiently robust defense industrial base that could support increased or dramatically changed requirements associated with reconstituted forces. Beyond the stated assumption that such a base would be available, few details are provided. It is not clear what the Department of Defense has in mind to ensure this capability. Current production lines are being allowed to go cold. We have a mismatch between strategy and resource decisions. In sum, there needs to be a theory or logic of reconstitution.

For the present, it is evident that the posture statements assume that sufficient inventory and surge capability either exist or would exist in time to meet 'come as you are' contingencies.¹⁷

Further changes to the Pentagon's defense acquisition strategy will undoubtedly occur under President Clinton and Secretary of Defense Les Aspin. It is too early to determine the extent to which the Aspin Plan will be assimilated into Pentagon acquisition policies, or the resulting impact it will have on the defense industrial base. While it is the responsibility of the executive branch to conduct national security planning, it takes agreement between the legislative and executive branches to

provide a defense acquisition strategy that is both resourced and executable. It is relatively certain, however, that a Democratic Congress and Administration will change the current defense acquisition strategy.

THE ASPIN PLAN: DEFINING THE PROBLEM

The Aspin Plan is based on the premise that the new world era requires a new world defense budget, thus dictating major changes in the conduct of American defense. The requirement for real cuts in the defense budget demands a new defense acquisition strategy that effectively matches our defense needs with a decreasing defense budget. In February 1992, then Representative Aspin noted that

(the) current system for equipping U.S. military forces - including research, engineering, development, production, and maintenance of defense systems - was crafted during an era of economic and technological superiority, abundant fiscal support, and a market rich with domestic suppliers. None of these conditions apply any longer. ... We need a new research strategy for guiding investment decisions, a strategy which maximizes our ability to support current requirements, ensures the survival of those technological and industrial resources critical to achievement of future objectives, and hedges against the risk of unforeseen national emergencies.¹⁸

Aspin's resource strategy recognizes the linkage between the defense industrial base and future defense needs. Recent experience in the Persian Gulf War illustrated the importance of applying overwhelming force in response to crisis. The

importance of high-technology weapon systems in the hands of trained and ready troops was evident for all the world to see.¹⁹ Our defense acquisition system had successfully developed, produced and fielded superior high-technology equipment that allowed decisive victory with minimal losses. The defense industrial base had delivered on the military buildup of the 1980's.

But can the defense industrial base of the future, devastated by low defense budgets and cutthroat competition, develop, produce, field and support the weapon systems of the future? Aspin has identified five capabilities that the future defense industrial base must possess in order to meet military needs.²⁰

1) Deliver goods currently on contract. Since the development and production cycle for equipment can run for ten or more years, it is necessary for the industrial base to remain healthy enough to meet this requirement.

2) Maintain/upgrade existing equipment. Since the mid-1980's, the number of military suppliers has shrunk from 120,000 to 30,000.²¹ Reductions in defense spending will ensure further reductions to the supplier base, jeopardizing the ability to maintain and upgrade existing equipment.

3) Survive to produce next generation systems - with high quality and at affordable rates. Production lines are shutting down for many defense programs over the next few years, creating gaps for future production requirements. General Dynamics is the

only U.S tank producer. Until recently, the Bush administration was willing to shut down the Abrams tank production line despite the validated need for a follow-on tank (the Block III tank). This scenario is present in many industrial sectors, including shipbuilding, aircraft manufacturing and ground combat vehicles production.

4) Develop new high technology. The ability to develop and integrate high technology into future weapon systems depends on the health of the industrial base. The U.S defense industry employed 342,000 engineers in 1990, approximately 18 percent of the nation's engineers.²² Creating gaps in production of current weapon systems will force contractors to disband research, development and production integration teams, threatening the technical sophistication of future weapon systems.²³

5) Provide a basis for reconstruction. The ability to reconstitute American military forces before an enemy is able to develop and field superior weapon systems is directly related to the health of the defense industrial base.

THE ASPIN ACQUISITION STRATEGY

The Aspin acquisition strategy is based on the premise that America should pursue, "a research and development system, rather than a develop and buy system"²⁴ such as is currently in place. Former Representative Aspin outlines three criteria that must be met before any system should enter production:

First: No production unless the projected

threat honestly justifies it.

Second: The developer's technology must be able to do the job.

Third: Even if the threat is real and the technology works, the technical developer must show that existing equipment can not be improved to handle the threat before new equipment can be produced.²⁵

The acquisition strategy consists of four elements, each designed to meet future defense needs while maintaining the defense industrial base. Taken individually, none of the elements will meet all of the industrial base requirements listed earlier. However, according to Aspin, when taken collectively the elements attain the desired synergistic effects. The Aspin acquisition strategy elements are as follows:

I. SELECTIVELY UPGRADE: Upgrading fielded equipment is often a quick and cost effective means of improving system performance. Aspin outlines the following three advantages of such upgrades: "(a) allows modernization of systems where new production is no longer fiscally prudent; (b) utilizes production capacity that also contributes to surge requirements; and (c) sustains the production base for future production systems."²⁶ Upgrading of fielded equipment should be the first option considered for attaining necessary performance improvements. The example of system upgrade used in Aspin's paper is the M1 to M1A2 Abrams tank upgrade program.

II. SELECTIVE LOW-RATE PROCUREMENT: When upgrading of fielded equipment is not feasible, low-rate production of selected systems may be the only means of sustaining the critical

components of the industrial base. Examples of the type of programs that are candidates for low-rate production include highly specialized industries that are already limited to sole source contractors, such as naval nuclear propulsion. Another rationale for low-rate production may be to act as a hedge against the uncertainties of future production. Aspin cited the F-16 as an example of a low-rate production candidate as a hedge against problems with the Advanced Tactical Fighter (ATF) development.

III. ROLLOVER-PLUS: While the first two elements of the acquisition strategy are aimed at sustaining the industrial base for critical production components, additional action must be taken to develop critical technology for future weapon systems. Rollover-plus is a system of continuous prototyping of advanced technologies, taking the emerging technologies and lessons learned from one prototype and incorporating that technology into a subsequent prototype. The technology would not enter production unless the following criteria were attained: "a) the technology works; b) it is required by development of the threat; or c) represents a breakthrough that would alter battlefield operations."²⁷

Aspin cites the Block III tank as a candidate for rollover-plus. There are no current production plans for the Block III tank due to the budget restrictions and dissipation of the Soviet threat. However, the lessons learned from the Block III technology demonstrators can be rolled-over into future

prototypes, providing the eventual technology for next generation systems.

IV. **"SILVER BULLET" PROCUREMENT:** Aspin defines silver bullet procurements as, "highly capable systems procured in limited quantities and reserved for operations where a high-tech advantage could maximize U.S. leverage."²⁸ While silver bullet procurements are not intended to sustain the industrial base, they are a critical components of a cost effective defense strategy. An example of a silver bullet procurement is the F-117 that was so effective in the Persian Gulf War.

ANALYSIS OF THE ASPIN STRATEGY

PART ONE: SELECTIVE UPGRADE: The first element of the Aspin Plan is the **selective upgrade** of fielded military equipment. The Abrams tank system, specifically an M1 to M1A2 Abrams tank conversion program, was cited by Aspin as a selective upgrade candidate.²⁹

Since budget limitations will no longer allow the services to pursue traditional methods of equipment modernization (i.e. development, production and fielding of new weapon systems to replace existing weapon systems), it is necessary to devise new ways of getting technological and operational improvements into the field. The primary means to modernize defense equipment should be through the block modifications of existing fielded

weapons systems.³⁰

The Abrams tank system, consisting of approximately 8,100 fielded M1, M1A1 and M1A2 tanks, comprise the backbone of the Army's armored forces. The importance of the technological superiority of the Abrams tank over the Iraqi Soviet-supplied tank force was evident during the recent Persian Gulf War.³¹ Yet the overwhelming technical superiority of the American tank force in the Persian Gulf War was achieved through replacement of less capable M60A1 tanks (in the hands of the Marine Corps) and M1 Abrams tank (in some of the early deployed Army units) with M1A1 Abrams tanks that possessed advanced armor, improved firepower (120 mm gun verses 105 mm gun) and a nuclear, biological and chemical (NBC) overpressure system prior to entering combat with the enemy.³² While Army forces probably would have accomplished all assigned missions with the originally deployed equipment, it is probable that the victory would have been more costly in terms of time and casualties.³³ Therefore the need to constantly improve the combat effectiveness of the Army's main battle tanks is required in order to ensure overwhelming technical superiority on tomorrow's battlefield.

Technical superiority of the Army's tank fleet can be maintained in three ways: 1) through development and fielding of an improved tank (such as the Block III tank); 2) production of more sophisticated tanks (such as the M1A2) to replace older tanks (such as the M1); or 3) conversion of older tanks into more capable newer tanks (M1 to M1A2 tank conversion). Since

development, production and fielding of a new generation tank is not affordable within the current budget constraints, nor threat justified at this time, the Army has decided to procure enough M1A2 tanks to equip Force Package 1 units. Instead of producing new M1A2 tanks to meet this requirement, the Army opted for the economically efficient conversion of existing M1 tanks to the M1A2 tank configuration.³⁴

But will an M1 to M1A2 conversion program maintain the tank industrial base? In order to answer this question it is necessary to review the recent history of Abrams tank production. The president's Fiscal Year 1990 defense budget submission called for the Army to "lay away" (defined as the storage of production tooling, fixtures, machinery, and test equipment until needed for future production requirements) the Detroit Arsenal Tank Plant (DATP) in September 1991 and shift remaining tank production to the Lima Army Tank Plant (LATP). Delivery of the last Abrams-series tank for U.S. forces was scheduled for March 1993. Although Saudi Arabia had agreed to purchase 435 M1A2 tanks from General Dynamics under a Foreign Military Sales agreement, the Saudis had the option to back out of the commitment if the U.S. Army failed to produce the M1A2 for domestic use. Once again, in the president's Fiscal Year 1992 budget, the Army planned to cease all domestic tank production in March 1993 after the production of 62 M1A2 tanks for U.S. use. Congress, however, refused to provide funding to mothball DATP, removing the money from the defense budget. If the president's

Fiscal Year 1990 and 1992 budgets had been approved as submitted, both U.S. tank plants would be closed down, all tank plant workers layed off, and the entire tank industrial base eliminated.

Could the U.S. mothball the tank plants, leave the production lines cold for up to ten years, and then restart production in response to a national crisis or for the production of a new generation of tank? The answer according to George Psihas, Vice President of General Dynamics Land Systems Division is a resounding, "no!"³⁵ The impact of mothballing the tank plants and going to a cold tank industrial base would be in three areas:

- 1) Unique labor skills would be lost as skilled personnel were layed off. Since tank fabrication is labor intensive, the critical skills unique to tank production would be permanently lost. For example, ballistic welders are integral to completing the 1.5 miles of welded joints that hold together the steel plates that comprise the tank's hull and turret. The only other place in military or commercial industry that ballistic welders require the skill and training of tank production is in nuclear submarine production and repair. These skilled welders are in demand throughout the economy at lesser skilled jobs. Once tank production ceases, these personnel will find employment outside the local area and not be available for future production. The few welders that return will require refresher training and requalification testing to attain recertification as ballistic

welders.

2) The manufacturing technology associated with tank production is unique. There are no, "military or commercial equivalents to the robotics and high deposition welding rate weld techniques and component machining systems for rolled homogeneous and high-hard armor alloys. With no commercial equivalent in many of the tank process and technology areas, this accumulated knowledge will be greatly diminished if not lost completely if tank production is stopped."³⁶

3) Significant portions of the Abrams tank supplier base would be lost, much of it permanently. A General Dynamics survey of the Abrams tank supplier base to, "determine what would happen if tank production ceased resulted in the following data: fifteen percent of the suppliers said they would go out of business entirely; another 30 percent would be severely affected requiring closure of plants or portions of plants dedicated to tank production; all reported significant negative impact."³⁷ Mr. Psihas states that, "from a cold base it would take 48 months to deliver the first tank, and 56 months to reach a production rate of 20 tanks per month. It's a myth that (General Dynamics) could ramp up tank production to meet a crisis."³⁸

Based on an April 1992 **Tracked and Wheeled Vehicles Industrial Sector Analysis** conducted by the U.S. Army Tank Automotive Command (TACOM), production ramp-up rates for mobilization quantities of Abrams tanks from a warm tank production base (defined as production of 20 tanks per month)

takes 21 months, a savings of 35 months when compared to mobilization from a cold tank production base.³⁹

The **Sector Analysis** confirms the uniqueness of the tank industrial base by stating, "There are no alternate commercial or foreign sources for the Abrams production base. At the termination of the Abrams Program at DATP and LATP, there will not be any similar products remaining in production. The economic realities of a disappearing industrial base will have serious implications in sustaining an adequate base for supplying critical and unique components in support of the Abrams tank. Such components include filters, rotary shock absorbers, and the torsion bar."⁴⁰

Further critical components for Abrams production that may not be available to support start-up from a cold base include the special armor manufacturing capability and the AGT-1500 turbine engine. The Department of Energy armor manufacturing facility provides special armor packages for the Abrams tank. The Sector Analysis summarizes the criticality of continued special armor production as follows:

The armor capability to support the tracked sector is generally available and the base can be maintained by the commercial market with the exception of Depleted Uranium (DU) armor which is produced by the Department of Energy for the Abrams Program. ... If the armored manufacturing base is allowed to remain cold in excess of one year, the manufacturing capability for all practical purposes would be lost and not available to support short term conflicts such as Operation Desert Shield/Storm. ... It would require 42 months or more if the base is cold in excess of two years.⁴¹

The AGT-1500 turbine engine manufactured by AVCO Lycoming-
Textron is another critical component of the Abrams tank which
could not be sustained by the commercial marketplace. The
recuperator module, for example, which consists of approximately
10 percent of the AGT-1500 engine's cost, is an intricate design
that requires unique welding and process control techniques. The
recuperator has been a major production and quality assurance
factor since the inception of tank production, and would cause
significant start-up problems from a cold base. The **Sector Study**
concludes that, "Adequate support requirements must be (retained)
in order to maintain this manufacturing base after Abrams tank
production ends."⁴²

Based on the above discussion it is clearly shown that the
tank industrial base would be severely strained in an attempt to
ramp-up from a cold industrial base. Also, laying away the tank
plants would result in an additional \$1.4 billion facilitization
cost for any future tank program.⁴³ If this is indeed the case,
why is it that the Pentagon has been so willing in the past to
allow the base to go cold? Former Deputy Secretary of Defense
Don Atwood expressed his viewpoints on ceasing tank production
and the corresponding impact on the tank industrial base in an
August 1991 interview, as follows:

Tanks are a very good example (of the impact
of going to a cold industrial base). We're
going to continue to develop advanced sub-
systems for tanks and upgrade their
performance. But today we have 7,000 of the
best tanks in the world, and we just don't
need to continue to build any more. I don't
feel we need to keep a hot production line

going. Rather, we need an industry capable of reconstituting itself if a crisis arises, and we have that. For instance, a manufacturer who makes 10,000-pound trucks or other large equipment can easily convert to tank production.⁴⁴

Mr. Atwood's position that any truck manufacturer could easily convert to production of modern main battle tanks, such as the M1A2 tank, appears to be without merit based on data provided by industry and outlined in TACOM's Sector Analysis. Perceptions concerning the ease of conversion and reconstitution reflect outdated lessons learned from World War II when the simplicity of tank design and relative ease of manufacturing allowed truck manufacturers to become tank producers; but those days no longer reflect reality in today's tank industrial base.⁴⁵ As long as industrial base decisions are made on perceptions as opposed to factual data, it will be difficult to implement a rational defense acquisition strategy.

The advantages of maintaining a warm (as opposed to cold) tank industrial base have been outlined above. However, will an M1 to M1A2 Abrams tank conversion program be sufficient to retain a warm production base? The monthly quantity of tank conversions is an important aspect to the industrial base. In February 1992, Army Chief of Staff General Gordon Sullivan issued his support for an Abrams upgrade program consisting of 10 tanks per month and approximately \$400 million per year.⁴⁶ Upon leaving office in January 1993 President Bush submitted the proposed DOD budget for Fiscal Year 1994. This budget called for an Abrams conversion program of six tanks per month and approximately \$250

million per year.⁴⁷

A precursory examination of the conversion program provides the following data⁴⁸:

- Special Armor: A conversion program of 60 tanks per year would sustain the special armor production facility. It should be noted that production rates for special armor are inelastic, with a fixed workforce regardless of rate. The special skills and certifications of manufacturing personnel are unique for most members of the manufacturing team, requiring those personnel to be retained regardless of the monthly production rate (up to the capacity required to add a second production shift).

- AGT-1500 engine: While a conversion program will not result in new production of AGT-1500 engines, it will result in a high percentage of new recuperator and critical turbine components sufficient to retain a warm industrial base.

- Critical welding Skills and Processes: A conversion program will require fabrication of new tank turrets in sufficient quantity to retain a warm industrial base.

- Filters, rotary shock absorbers, and torsion bars: A conversion program, coupled with increasing requirements for replacement spare parts as the overall tank fleet ages, should be sufficient to retain a warm industrial base.

In summary, an M1 to M1A2 tank conversion program should be sufficient to maintain a warm (marginal) tank industrial base even in the absence of any other tank production. However the real key to retaining a healthy tank industrial base is continued

foreign military sales, which could support substantial new tank production. A case in point is the tank sale to Saudi Arabia for 465 M1A2 tanks (with a potential increase to 700). Saudi refused to commit to the M1A2 tank until it was clear that the U.S. would produce the M1A2 tank for domestic use. Additional Foreign Military Sales of the M1A2 tanks are proposed for Kuwait⁴⁹ (up to 760 tanks), while Sweden is looking at the German Leopard II and the French LeClerc as well as the Abrams.

PART TWO: SELECTIVE LOW-RATE PROCUREMENT: The second element of the Aspin Plan is the **selective low-rate production** of critical components and weapon systems that are necessary to support future production requirements. Since all fielded systems may not be suitable for upgrade, it may be necessary to conduct low-rate production of certain critical components or weapon systems if the industrial base is to be maintained.

The advantage of retaining a low-rate production capability for critical components is that the entire supplier base for the weapon system is sustained at least at a minimum level. Since many of the critical components for a complex weapon system are located at the second, third or fourth tier of the supplier base⁵⁰, conducting low-rate production will retain at least a minimum capability for all elements. Additionally, an ongoing production capability will significantly lower the price and

improve the availability of spare parts to support already fielded systems. According to a recent vendor survey of a major weapon system, spare part prices would increase by 50 to 100 percent if the ongoing weapon system production line was terminated.⁵¹

An additional benefit of sustaining a warm production base for military weapon systems is the broadening of the repair and retrofit capacity. An ongoing military production line allows the government to attain accelerated repair/replacement of critical system components by utilizing float production capacity at the prime or subcontractor level that may not be available if a warm production base is lost.

The Aspin Plan cites the shipbuilding industry, in general, and naval nuclear propulsion, in particular, as candidates for the selective low-rate procurement strategy.⁵² This portion of the study will address the impact of the Aspin Plan on the Seawolf-class attack submarine and the resulting impact of low-rate production on the submarine sector of the defense industrial base.

America's shipbuilding capacity has collapsed over the past decade. From a robust industry consisting of 110 shipyards employing 112,000 workers in 1981, the industrial base has been reduced to 64 shipyards and 76,000 workers in 1989.⁵³ During that same period, the number of primary shipyards decreased from 27 to 16.⁵⁴

America's commercial shipbuilding industry has become almost

entirely dependent on Navy contracts. American shipyards received orders for only three commercial ships since 1985, and all of those ships are being built at the NASSCO shipyard. During that timeframe, U.S. Navy contracts accounted for approximately 95 percent of all American shipbuilding work.⁵⁵ The decline in America's commercial shipbuilding fortunes is linked to the elimination of the U.S. construction differential subsidy (CDS) in 1981 as well as the significant amount of own government subsidies received by foreign shipyards. In February 1992 Representative Helen Delich Bentley stated, "The (U.S. commercial shipbuilding) industry will not survive unless foreign subsidies are abolished."⁵⁶ Providing U.S. shipbuilders with subsidies comparable to foreign competitors would broaden the U.S. shipbuilding base, enhance competitiveness, and allow more U.S. shipyards to survive the military drawdown.

The loss of commercial shipbuilding capability affects America in several important ways. First, the burden of maintaining the shipbuilding industrial base in America is defaulted to the government for new ship construction. Therefore, U.S. Navy contracts will determine the health and survival of the shipbuilding industry. Second, since the defense restructuring will limit the quantity and value of future military ship contracts, it is probable that a large number of remaining shipyards will go out of business in this decade or be closed as a result of Base Realignment and Closure (BRAC) decisions. This action would result in a significant reduction

in surge and mobilization capability. America's ability to replace older ships with new production, convert and refurbish existing ships to incorporate technological improvements, and perform necessary repairs are necessary elements of any mobilization strategy. Finally, fabrication of fewer ships will result in fewer U.S. flag vessels that can be directed to respond to national contingency requirements. Since U.S.-flag carriers accounted for, "29 percent of all dry cargo transported to Mideast/Persian Gulf ports for U.S./coalition forces" during the Persian Gulf War, and "some 80 percent of all Desert Shield/Storm oceanborne cargo was carried by U.S.-flag ships"⁵⁷ during that conflict; the contribution of American commercial shipping in support of military operations is indisputable. Collectively, these factors illustrate what America is forfeiting by loss of commercial shipbuilding capability.

Currently there are only two U.S. shipyards that are capable of building nuclear submarines - the Electric Boat shipyard in Groton, Connecticut run by General Dynamics, and the Newport News Shipbuilding and Dry Dock Co. in Newport News, Virginia run by Tenneco.⁵⁸ The Seawolf-class attack submarine is arguably the most technically advanced and militarily capable submarine in the world.⁵⁹ Originally a 29 ship program with projected total cost of \$44 billion, the Seawolf program represented continuous production for both shipyards well into the next century. Without the Seawolf production, the ten remaining Los Angeles-class submarines currently under construction would cause the

submarine line to go cold at both shipyards before a new submarine could be developed and enter production.⁶⁰

The defense drawdown and budget concerns have substantially impacted plans for navy shipbuilding. The 600 ship navy of the mid-1980's is heading towards the 350 ship navy of the mid-1990's. This is a significant reduction since the navy was close to attaining the 600 ship goal at the height of the buildup.

As a result of the drawdown, the fate of the Seawolf submarine program is in doubt. The original Seawolf acquisition plan called for procurement of three submarines per year at a \$2 billion per unit cost. The initial Seawolf submarine contract was awarded to General Dynamics Electric Boat Division in 1989. General Dynamics was also selected for award of the second Seawolf submarine in May 1991, but the award was set-aside due to inappropriate influence by Don Yockey, the former Under Secretary of Defense for Acquisition.⁶¹ As a result the second Seawolf has yet to be awarded.

The FY93 budget proposed to terminate the Seawolf program after the initial submarine, but Congress reinstated funding for the second submarine.⁶² Although President Clinton supported continued Seawolf production during the recent campaign,⁶³ production beyond the second Seawolf is uncertain since the submarine was originally designed to counter a Cold War threat which may no longer exist.

The fate of the Seawolf program will determine the survival of the nuclear submarine defense industrial base. Both General

Dynamics and Tenneco have gone on record as stating that award of the second Seawolf submarine, "was a life-or-death matter, affecting thousands of jobs, determining the health of the largest corporate employer in the region, and potentially reshaping the nation's submarine building industry."⁶⁴

Even a stretchout of the Seawolf program to one or less submarines per year would cause one of the two shipyards out of the submarine business. The major question is whether the final rate of submarine production will be sufficient to support even one shipyard. Most analysts believe that once the current submarine orders are completed, "the Navy would have to build a new submarine every two or three years ... just to keep alive the craft of building submarines."⁶⁵

The fate of the Electric Boat shipyard is especially dependent on continued Seawolf production. The Electric Boat shipyard builds only submarines and is the most efficient of the two submarine production shipyards. The automated hull welding machines, sophisticated design shop and modular construction facility are specially developed to efficiently produce submarines.⁶⁶

Even though Electric Boat possesses an unquestionable economic advantage in submarine production over Newport News, as illustrated by the bid of 12 percent less than Tenneco for the fabrication effort on the second Seawolf procurement⁶⁷, the Newport News shipyard possesses an inherent advantage as a multi-purpose producer of both submarines and aircraft carriers. Some

analysts suggest that the multi-purpose production capability of Newport News will be the deciding factor if only one submarine shipyard is to survive.⁶⁸

Regardless of which shipyard survives the Seawolf competition, the cost impact of stretching out submarine production will be substantial due to significant changes in the current production methodology and reduced quantities of component parts. General Dynamics estimates that the cost to the Navy to build one Seawolf submarine per year at a single shipyard would be 25 to 30 percent less than the cost to build one submarine each two years at each shipyard.⁶⁹ The shrinking U.S. defense budget, however, will force Congress and the Department of Defense to consolidate submarine production at a single shipyard.

While a comprehensive study of the nuclear powered submarine industrial base is ongoing, several critical subcomponents and industrial skills necessary to support production have already been identified. David Cann, former Assistant Secretary of the Navy for Research, Development and Acquisition, states that existing Navy studies have identified critical components and processes in, "fairly standard systems such as submarine air conditioners and ventilation systems (that) have special engineering and tolerance requirements that have no counterpart in the commercial market" to, "unique submarine components such as nuclear propulsion systems. (Additionally) the Navy fears that once key shipyard skills such as welding are lost, they will

be difficult to retain."⁷⁰

The argument that manufacturing skills are critical to maintenance of the industrial base has been disputed by top government officials (see discussion of Mr. Atwood's position on Abrams tank production under the selective upgrade option). Mr. Cann, however, provides the following example of how the loss of critical workers affects a production effort:

It's like when the gas station on the corner fires his master mechanic, and a few months later hires an apprentice. Suddenly you can't figure out why your car doesn't work. That's exactly the problem we face with submarine (production).⁷¹

In summary, the Seawolf attack submarine program is representative of the industrial base decisions facing the nation today. Continued production of the advanced technology Seawolf is not required by the emerging threat; therefor continuation of Seawolf production is primarily based on industrial base considerations. The political process will determine whether America will retain a nuclear submarine production capability, which could be supported by production of as few as one Seawolf submarine each three years at a single shipyard.

The decision to build the second Seawolf only delays the tough industrial base questions with which the nation must deal. Under the Aspin Plan continuous low rate production of the Seawolf at a single shipyard is justified in order to retain future nuclear submarine production capability. Since upgrades to the current submarine fleet would not sustain the critical components of the industrial base, the only alternative to cold

production lines is continuing low-rate production of the Los Angeles-class or Seawolf-class submarines. Furthermore, America needs to determine whether maintenance of a minimal commercial shipbuilding capability is in the nation's best interest, and if so, take appropriate action before America's shipyards are completely lost.

PART THREE: ROLLOVER PLUS: The third element of the Aspin Plan is "rollover plus", a "process of continuous prototyping and development of manufacturing technologies."⁷² This strategy calls for multiple cycles of research and development, taking the technology developed during one cycle and "rolling" that technology over to the next generation of research and development prototype.

The advantage of the rollover-plus approach is that it allows for development of advanced technologies into a prototype system without incurring all of the cost associated with the traditional material development cycle. By utilizing the lessons learned from earlier prototypes, the subsequent development effort can leapfrog one or more generations of equipment prior to making a production decision. The technology remains in the advanced development cycle until the system is ready for production and a valid need for the system exists.

The "plus" in the Aspin Plan refers to the strategy of conducting enough operational-level testing to insure that the

system's design is adequate from a concurrent engineering and manufacturing technology perspective prior to entering production. This is the area in which the Aspin Plan differs from the current Department of Defense acquisition strategy for continuous prototyping.⁷³

The Army's next generation main battle tank, the Block III tank, was identified by Aspin as a candidate for the rollover-plus strategy. With the demise of the Soviet Union and planned upgrade of the Abrams tank fleet, the need for development, production and fielding of a Block III generation tank can not be justified by the existing threat alone. However, the proliferation of sophisticated main battle tanks throughout the world requires action by America in order to retain the capability of applying overwhelming force in response to future military contingencies. Confirmed and probable sales of M1A2 Abrams, the French LeClerc, and British Challenger II to nations in the Middle East are examples of main battle tanks that are superior in performance to America's M1 and M1A1 Abrams tanks that were so dominant in the Persian Gulf War. It is therefore necessary for America to continue the development of leap ahead tank technology in order to insure dominance on the battlefield of tomorrow.⁷⁴ In the words of former Chief of Staff Carl Vuono:

... we cannot afford to become complacent. We must ensure that we stay on the cutting edge of technology. We must maintain the same battlefield advantage into the next century that let our tanks see and kill targets at over 3000 meters; the edge that put sabot rounds through the defensive berm, through the front glacis, and through the

engine block of a T72 before exiting the rear of the tank.⁷⁵

An effective acquisition system must develop future weapon systems that are equal to or superior to threat systems.⁷⁶ The primary question for this study is whether the rollover-plus strategy will support a sufficient industrial base to develop the resulting leap ahead technology, and in conjunction with the remaining elements of the Aspin Plan, sustain an industrial base capable of producing and fielding the next generation system? Since successful prototyping is dependent on the knowledge and skill of individuals, the major challenge for the industrial base is to attract and retain skilled engineering and management personnel during the lean years of little or no production until future production of the advanced system is authorized.⁷⁷

The key to an effective prototyping strategy is twofold: a) selection of the critical technologies that must be pursued in order to develop and produce the advanced systems of the future; and b) once the technology thrust is selected, application of sufficient funding to support a continuous research and development program at a level sufficient to retain personnel expertise in the thrust area.

The Department of Defense (DOD) appears well positioned to accomplish these two criteria. In May 1992 former Under Secretary of Defense Don Yockey identified seven Science and Technology (S&T) Thrusts that would focus military development in critical technologies that are necessary for future weapons dominance, while at the same time addressing the user's most

important military and operational needs. While it is unclear what impact, if any, President Clinton's direction to drive military research and development towards dual use (joint military and commercial) applications will have on this strategy, the seven S&T Thrusts are as follows:⁷⁸

- 1) Global Surveillance and Communications;
- 2) Precision Strike;
- 3) Air Superiority and Defense;
- 4) Sea Control and Undersea Superiority;
- 5) Advanced Land Combat;
- 6) Synthetic Environments;
- 7) and Technology and Affordability.

Advance Land Combat is the technological thrust that will contribute to development of America's Future Main Battle Tank (FMBT). The Advanced Land Combat technology thrust includes all actions that enhance, "the ability to rapidly deploy ground forces to a region, exercise a high degree of tactical mobility, and neutralize the enemy quickly and with minimal casualties in the presence of a heavy armored threat and smart weaponry."⁷⁹

DOD also appears intent on providing adequate funding to finance the S&T Thrusts. According to some analysts, "within five years it is more than likely that the procurement and RDT&E accounts will be equal in size instead of the more traditional two-thirds/one-third split."⁸⁰ It should be noted, however, that the level of RDT&E funding in future budgets is far from decided. The proposed Bush FY94/95 budget statement recommends that the

traditional split between procurement and RDT&E be retained.⁸¹

A significant factor affecting the preservation of the industrial base is the decision as to where the prototyping effort will be performed. Prototyping can be conducted at government arsenals or by defense contractors. While both government arsenals and defense contractors currently possess the technical capabilities to conduct prototype activities, it is critical that a significant portion of the research and development effort remain with defense contractors in order to provide an efficient transition to production as required.⁸²

The potential competition between the government and industry for the limited research and development budget, coupled with the impact of retaining the majority of that budget within the government arsenals, was addressed in a recent **Program Manager** article. Some conclusions of the article were that, "Weapon systems have problems in transition from development into production. Without some experience in production of certain systems, it will be impossible to take a design and move it rapidly and successfully into production. The expectation of taking 'technology on the shelf' and executing easy and prompt production could promote a false sense of security."⁸³

The FMBT (Block III) is an excellent example of how the rollover-plus methodology would work. According to the Star 21 Study (Strategic Technologies for the Army of the 21st Century), the next generation main battle tank should be, "a highly maneuverable, armored vehicle" that is "lighter and more agile"

than the current Abrams tank but with "increased lethal power." Important technologies that should be incorporated into the FMBT include, "stealth technology, advanced materials, and new propulsion concepts" that "can maintain or increase tank survivability and mobility."⁸⁴

The Army Technology Base Master Plan (ATBMP) further identifies 14 emerging technologies that are directly applicable to the armored force of the future.⁸⁵ These technologies include the following areas of concentration:

- Protection/Lethality;
- Advanced Materials and Material Processing;
- Low Observable Technology;
- Microelectronics, Photonics, and Acoustics;
- Advanced Signal Processing and Computing;
- Artificial Intelligence;
- Robotics;
- Power Generation, Storage and Conditioning;
- Advanced Propulsion Technologies;
- Directed Energy Weapons;
- Space Technologies;
- Biotechnology;
- Neuroscience Technology;
- and Advanced Manufacturing.

A primary example of leap ahead technology that could be incorporated in the FMBT is revolutionary improvements in gun technology. Had the Army retained plans for completing

development of the Block III tank by 2001 and entering production in 2002, conventional gun technology would have been utilized. However, the restructuring of the Armored Systems Modernization (ASM) program in general, and the Block III tank program in particular, "could give the Army time to allow the contractors to demonstrate the viability of the electrothermal (ET) gun as a possible upgrade for the (Abrams) tank and as a possible main gun for the FMBT."⁸⁶

The electrothermal gun promises a revolutionary breakthrough in main battle tank lethality. ET gun technology could provide launch velocities of "about 2.5 km/sec" compared to current 120mm gun velocities of "about 1.6 km/sec", speeds that are "more than a match for any passive or reactive armor known to be under development."⁸⁷ According to retired General John W. Foss, the technological impact of such a weapon system would be substantial:

Hypervelocity takes you about four generations beyond the armor-antiarmor debate of the mid-70's to late-80's. It's not a question of whether you destroy the tank - you knock it over. It takes off the turret - things like that. So you can add all kinds of plates and all kinds of ceramics and other things, but if your tank gets knocked over, sideways, it's destroyed.⁸⁸

It is important to understand the role that the contractor industrial base is playing in the development of hypervelocity gun systems for the FMBT. Most of the basic research and development work conducted on a hypervelocity gun has been done by industry under contract to DARPA or using Independent Research

and Development (IR&D) funding. A leading contractor in this area is General Dynamics Land Systems Division (GDLS), a company that has demonstrated an ET gun prototype. According to GDLS, the ET gun could enter full scale development by 2004 or sooner if sufficient government funding is provided.⁸⁹

Significant work has already been accomplished in prototyping of the FMBT (Block III). According to former Deputy Secretary of Defense Don Atwood, " we have available prototypes of the Block III (tank) We will be building some and testing them to demonstrate the technology and demonstrating the manufacturing capability, but not going into production until they are needed."⁹⁰

But the Army's record does not indicate consistent support for prototype development. The Common Chassis Advanced Technology Transition Demonstrator (CCATTD) contracts were awarded to Teledyne Continental Motors (TCM) and AVTA in December 1990. The CCATTD was intended to provide a common chassis (in the form of a heavy and light platform) for the six variants planned under the Armored System Modernization (ASM) program. In November 1991 a contract stop work order was placed on all tank specific development of the CCATTD. Based on a need to totally restructure the ASM program to shift emphasis to the AFAS and FARV-A efforts, the CCATTD contract was formally terminated in October 1992.

In the short time that the contract was in effect, however, significant progress was made in the development of advanced

signal processing and computing capabilities through the Standard Army Vetronics Architecture (SAVA) effort, improvements in propulsion technology through the Advanced Integrated Propulsion System (AIPS) that has already reduced the size of the power-pack by 50 percent, and development of advanced materials.⁹¹ The lessons learned from this generation of Advanced Technology Demonstrator (ATD) will provide the basis for technology to skip future generations when the FMBT finally enters production.

In summary, the rollover-plus element of the Aspin plan is an intelligently designed prototyping strategy for the cost effective development, production and fielding of tomorrow's militarily superior weapon systems. A 1991 report by the Office of Technology and Assessment (OTA) supports this conclusion by stating that, "a properly managed prototype strategy can protect key elements of the nation's ability to innovate in defense technology."⁹²

The key to success, however, is the way in which DOD implements the rollover-plus strategy. Methods of implementation will determine the effectiveness in providing advanced technology while maintaining the capability to transition to future production. Factors that will determine effectiveness of the strategy include: steady funding of technology thrust areas from year to year; the split of workload between government and industry; and implementation of an acceptable method to reduce the prime contractor base to a small number (a single source in many cases) that are capable of developing, producing, fielding

and supporting future weapon systems in a cost effective manner.

Of these factors, the most critical element is consistent funding of the key thrust technologies to allow engineering and management teams to remain intact. Industry can make business decisions reacting to the government/contractor split of R&D and the Darwinian reduction in the composition of the industrial base. However, if industry is expected to retain highly skilled (and expensive) engineering personnel during this period of restructuring, the government must provide accurate long term planning information upon which to base staffing levels. The level of government funding does not have to be excessive, but it must be consistent and focused at the contractor level.

PART FOUR: SILVER BULLET PROCUREMENT: The fourth

element of the Aspin Plan is the **Silver Bullet procurement**.

Silver Bullet procurements are, "highly capable systems procured in limited quantities and reserved for operations where a high-tech advantage could maximize U.S. leverage."⁹³ Since a Silver Bullet procurement must, "meet the criteria for bringing a rollover-plus prototype into production, (that is) it must represent a significant technical advance, and must demonstrate the potential to alter battlefield operations,"⁹⁴ a probable source of tomorrow's Silver Bullet procurement will probably be one of today's rollover-plus projects. The F-117 Stealth fighter, which proved so successful in evading Iraqi radar during

the Persian Gulf war, is a prime example of a successful application of the Silver Bullet procurement philosophy.

Since Silver Bullet procurements are often classified programs until such time as they enter production, this study will look at the F-117 Stealth and its impact on the defense industrial base. The F-117 program affects the industrial base in two areas: first, it requires a capable engineering and management team to design, fabricate, test and troubleshoot the system at the prime (integration) contractor; and second, it requires a high-tech subcontractor base to provide key technological components for the system.

Lockheed, the developer and manufacturer of the F-117, proved that a very low rate production facility could be established that would, "push the existing bounds of technology" while limiting cost to the government and providing a profit to the contractor. The Lockheed "Skunk Works" methodology, which developed and produced the U-2 and SR-21 systems as well as the F-117, tooled up to produce limited numbers of select aircraft per year.⁹⁵

The key to the production of Silver Bullet projects is to plan an efficient, very low rate of monthly/yearly production at the prime contractor and subcontractor level, thus containing cost and stabilizing personnel requirements. The success of the F-117 program in maintaining performance while limiting production cost is impressive. Considering that only fifty-nine F-117 Stealth aircraft were produced, the average unit flyaway

cost of \$42.6 million is remarkable.⁹⁶

The lessons learned from the Lockheed experience is that with proper planning and execution, cost effective production at a very low rate can be accomplished. An additional lesson for the defense industry in these times of reduced military budgets is that prime contractors who fail to adapt their research, development and production facilities and tailor their personnel staffs to very low rate production will not survive the defense industry shakeout.

In summary, the judicious funding of a reasonable number of Silver Bullet procurements can result in maintaining a minimal industrial base for these force multiplier programs (i.e. those technically superior weapons that allow a small force to fight with the combat effectiveness of a much larger force). The key to sustaining this portion of the industrial base is to establish the very low rate production parameters up front, provide consistent funding, and insure that the selected prime contractor tailors the production line and personnel staffing levels to provide efficient and cost effective results.

CONCLUSIONS

The Aspin Plan presents a resource allocation strategy that effectively balances the following national concerns: 1) provides a framework for sustaining the defense industrial base; 2) continues to develop, produce and field high-tech military systems that will ensure America's predominance on tomorrow's battlefield; and 3) accomplishes 1 and 2 above under the continuing military budget reductions of the defense restructuring.

The reason that the Aspin Plan successfully balances the critical national concerns in the defense arena is because it effectively addresses each concern in a rational and analytical manner. A summary of the Aspin Plan components will illustrate the methods by which the national concerns are accommodated.

The first two elements of the Aspin Plan address sustainment of minimum production capabilities in defense unique industries. By selectively upgrading existing fielded weapon systems, it is possible to improve combat effectiveness at minimal cost while sustaining the industrial base for critical systems and subsystems. When upgrading fielded weapon systems is not feasible, selective low-rate procurement of new weapon systems is a means of sustaining critical suppliers which otherwise would be lost to the defense industry. Together, these first two elements of the Aspin Plan accomplish the following industrial base

requirements: 1) delivers goods already on contract; 2) maintains and upgrades existing equipment; 3) provides for a limited surge capability; and 4) retains warm production lines and skilled personnel teams until future production is justified by the threat.

The last two elements of the Aspin Plan address the means of developing, producing and fielding advanced military technology at costs substantially lower than the tradition acquisition cycle. This allows America to stay at the forefront of advanced technology, retain the ability to produce advanced military equipment when the threat justifies such action, and produce selected military equipment at low rates while providing revolutionary combat advantage regardless of threat.

The third element of the Aspin Plan is roll-over plus, the technique of using knowledge gained from one prototype developmental effort and rolling it over to subsequent prototype efforts. Since production of a roll-over plus prototype is withheld pending the evolution of a threat justifying new production, there is sufficient time to conduct developmental and operational testing, as well as conduct concurrent engineering and refine production processes.

The roll-over plus methodology provides the following benefits: 1) retains the design, engineering and management teams necessary to support future developmental efforts; 2) lowers the risk (and therefore the cost) of future production through continuous operational testing and concurrent engineering; 3)

continuously advances the state of the art for weapon system performance; and 4) avoids the cost of continuous production.

The fourth element of the Aspin Plan is the silver bullet procurement. While a silver bullet procurement could derive from the roll-over plus strategy of continuous prototyping, it could also be the product of a directed effort. In either case, a silver bullet procurement provides the capability to exploit breakthrough technology.

The Aspin Plan, however, only provides the overall strategy for allocating defense resources in pursuit of the goals stated earlier in this study. The method of implementation will determine the effectiveness of that strategy in the actual attainment of the goals. It is incumbent on the military services, Department of Defense, the President and Congress to develop policy and implement procedures that make maximum use of available defense funding. Given the past record of cooperation among those elements, it will take an extraordinary effort to attain major accomplishments in the current environment.

Although beyond the scope of this study, the following areas need to be addressed in order to effectively implement the Aspin Plan:

- 1) Each service must **complete a comprehensive sector analysis** in order to accurately identify those weapon systems, components and subcomponents that must be protected in order to retain an industrial base. Logical decisions as to resource allocation cannot be made without accurate, detailed knowledge.

2) The Bush support of a "laissez-faire, let the market decide" policy needs to be revised in order to efficiently restructure the industrial base. A policy of economic Darwinism (i.e. survival of the fittest contractors) will result in an industrial base that can no longer support current or future military needs. America needs an effective industrial policy to help defense contractors realign their assets and meet the requirements of both industry and government. Further, the declining defense budget will limit the amount of competition in the future industrial base.

3) Continuing reform of government acquisition requirements is imperative. Every effort must be taken to eliminate the artificial barriers between commercial and military products in order to sustain the industrial base and lower weapon system cost. An example of artificial requirements may be the electronics industry. This industry is integral to advanced technology weapon systems, yet only three percent of yearly production is consumed by the military. Despite the fact that commercial electronics have become the innovator of advanced technology, often leading the military market by a generation or more, few manufacturers are able to co-produce military and commercial components on the same production line. Stringent military specifications and requirements such as for nuclear hardening have effectively segregated military electronic production from commercial electronics production, driving up the cost and leadtimes for the military product.

4) The government and industry must jointly plan for realistic production requirements that reflect the current budget environment. Once credible planning is completed, industry must properly size production lines to meet military requirements without excess capacity. While proper sizing will lose some of the mobilization capabilities of the past, it will also result in the most economic production for the future, thus limiting cost and attaining the most "bang for the buck". Efficient production planning includes maximum use of flexible manufacturing systems, consolidating production of similar weapon systems at a single contractor facility, and initiating contractor teaming arrangements when justified.

5) The government should join with industry to increase the amount of Foreign Military Sales (FMS) of American weapon systems to those countries that are friends or allies. FMS sales are necessary to help maintain the balance of power in areas of the world that are critical to U.S. interests. The sale of U.S. weapons to foreign governments also allows the U.S. to retain a degree of future control over those weapon systems (and therefore governments) by providing the spare parts and system upgrades necessary for sustainment and growth. For example, the technically sophisticated fighters sold to the Shah of Iran were virtually incapacitated when the U.S. shut off spare and repair parts and engineering support after the Shah's death.

FMS sales can also sustain hot production lines for U.S. weapon systems while increasing jobs at home and American

influence abroad. If America fails to satisfy the market for advanced weaponry then it will be filled by the British, French, Germans, Italians, Chinese or Russians, with the benefits of such production going to the victor. The result will be the loss of American jobs, shutdown of military production lines affecting near and far term production capacity, and dissolution of America's ability to influence world affairs.

6) Better cooperation between the branches of government is required in order to **shift program planning from a short term to a long term perspective.** The military and Congress must ensure that a proper balance is attained between the military personnel and investment accounts in order to support a trained and ready force, equipped with technically superior weapons, and capable of implementing the military security strategy of the United States. Failure to achieve a proper balance between force structure and acquisition will result in a hollow military incapable of performing the required mission.

In summary, the Aspin Plan provides the framework for alleviating America's national concerns for balancing present and future military needs under a declining defense budget. If implemented correctly, the four elements of the Aspin strategy will support the production requirements of today, sustain the industrial base for those critical weapon systems and components of tomorrow, and continue to develop and selectively produce the advanced technology that is needed to retain overwhelming military superiority in the future.

Endnotes

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